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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the serial infrared ray communication unit which performs communication between other devices with infrared rays with the serial infrared-ray-communication mechanism of IrDA (Infrared Data Association) standard conformity especially about an infrared ray communication unit.

[0002]

[Description of the Prior Art] In the former and this kind of serial infrared ray communication unit, Below physical-link layer [it carries out using a serial infrared-ray-communication mechanism, and also manages the protocol of communication between devices.] used as an IrLAP (Infrared Data Association Serial Infrared Link Access Protocol) layer. It has the link management layer [it is hereafter considered as an IrLMP (Infrared Data Association Link Management Protocol) layer] which manages a data link using the service received from an IrLAP layer.

[0003] The serial infrared ray communication unit is provided with the upper layer software for having carried the serial infrared-ray-communication mechanism, and also performing communication between devices via an IrLAP layer, Connection of a circuit will be completed, if the UA (Unnumbered Acknowledgement) frame comes on the contrary from the IrLAP layer of other devices when the SNRM (Set Normal Response Mode) frame is transmitted from an IrLAP layer.

[0004] The connection handle which is an interface between an IrLAP layer and an IrLMP layer is generated in an IrLAP layer after this completion of connection, and generation of that connection handle is notified to an IrLMP layer.

[0005] That is, in the above-mentioned serial infrared ray communication unit, if a connection request is outputted to an IrLAP layer from an IrLMP layer as shown in drawing 5 and drawing 6 (drawing 5 step S21), the SNRM frame will be transmitted to other devices from an IrLAP layer (drawing 5 step S22).

[0006] Then, if the UA frame is received from other devices (drawing 5 step S13), an IrLAP layer will generate a connection handle and will notify generation of the connection handle to an IrLMP layer by a connection confirm (drawing 5 step S24).

[0007] An IrLAP layer notifies disconnect indication to an IrLMP layer that abnormalities occur after generation of this connection handle via a connection handle (drawing 5 step S26). (drawing 5 step S25) That is, it is specified that it performs the abnormality notice

from an IrLAP layer to an IrLMP layer as disconnect indication via a connection handle. [0008]If abnormalities do not occur (drawing 5 step S25), an IrLAP layer performs data transfer among other devices based on the directions from an IrLMP layer (drawing 5 step S27), repeats the processing till the end of data transfer, and performs it (drawing 5 step S28).

[0009]Like the above, with the conventional serial infrared ray communication unit, the generating timing of a connection handle is based on an IrLAP layer to the connection request from an IrLMP layer, and also it has become after the connection confirm with a device (i.e., after connection with other devices carries out normal termination).

[0010]

[Problem(s) to be Solved by the Invention]In the conventional serial infrared ray communication unit mentioned above. If abnormalities occur after the SNRM frame is transmitted to other devices from an IrLAP layer as shown in drawing 7 since the connection handle is generated after connection with other devices carries out normal termination, the SNRM frame will not reach other devices but the UA frame will be replied from other devices.

[0011]Therefore, since the UA frame from other devices is not received in an IrLAP layer and a connection handle is not generated, an abnormality notice (disconnect indication) cannot be notified to an IrLMP layer from an IrLAP layer.

[0012]Namely, in the conventional serial infrared ray communication unit, after a connection confirm is notified that is, can notify the abnormalities caused after connection normal termination to an IrLMP layer, but. Since the connection handle between an IrLAP layer and an IrLMP layer is not generated if abnormalities occur before connection normal termination before a connection confirm is notified that is, Abnormalities cannot be notified to an IrLMP layer and it does not have a means to notify the abnormalities in a negotiation result with other devices to an IrLMP layer.

[0013]Then, it is in the purpose of this invention providing the infrared ray communication unit which can notify the abnormalities in a negotiation result which cancel the above-mentioned problem and may be caused before connection normal termination to an IrLMP layer.

[0014]

[Means for Solving the Problem]An infrared ray communication unit by this invention is an infrared ray communication unit containing a physical-link layer which it carries out using an infrared-ray-communication mechanism, and also manages a protocol of infrared ray communication between devices, and a link management layer which manages a data link using a function of said physical-link layer, Said physical-link layer is equipped with a means to generate a connection handle which is an interface between said physical-link layer and said link management layer immediately after registration of a connection request from said link management layer, and to notify that to said link management layer.

[0015]Other infrared ray communication units by this invention possess a means to notify disconnect indication to said link management layer via said connection handle, in said physical-link layer, when abnormalities other than the above-mentioned composition occur in infrared ray communication between said other devices.

[0016]Another infrared ray communication unit by this invention contains a physical-link layer which it carries out using an infrared-ray-communication mechanism, and also

manages a protocol of infrared ray communication between devices, and a link management layer which manages a data link using a function of said physical-link layer, At the time of a connection-request receptionist from said link management layer.

Transmit a demand frame for a connection negotiation to a physical-link layer of said other devices from said physical-link layer, and in said link management layer from said physical-link layer at the time of reception of a response frame corresponding to said demand frame from a physical-link layer of said other devices a connection confirm. It is an infrared ray communication unit to notify, Said physical-link layer is equipped with a means to answer said connection request, to generate a connection handle which is an interface between said physical-link layer and said link management layer before transmission of said demand frame, and to notify that to said link management layer.

[0017]Furthermore it is based on this invention, another infrared ray communication unit possesses a means to notify disconnect indication to said link management layer via said connection handle, in said physical-link layer, when abnormalities other than the above-mentioned composition occur in infrared ray communication between said other devices. [0018]

[Embodiment of the Invention]First, an operation of this invention is described below.

[0019]In the infrared ray communication unit containing the IrLAP layer which it carries out using a serial infrared-ray-communication mechanism, and also manages the protocol of the infrared ray communication between devices, and the IrLMP layer which manages a data link using the function of an IrLAP layer, The connection handle which is an interface between an IrLAP layer and an IrLMP layer is generated in an IrLAP layer immediately after registration of the connection request from an IrLMP layer, and that is notified to an IrLMP layer.

[0020]It becomes possible to notify the abnormalities in a negotiation result which may be caused before connection normal termination to an IrLMP layer by this.

[0021]Next, one example of this invention is described with reference to drawings.

Drawing 1 is a key map showing the infrared-ray-communication protocol by one example of this invention. In the figure, the infrared-ray-communication protocols 1 and 2 are constituted including the IrLMP layers 11 and 21 and the IrLAP layers 12 and 22. Here, the infrared-ray-communication protocol 1 is carried in the serial infrared ray communication unit of a transmitting agency, and the infrared-ray-communication protocol 2 is carried in the serial infrared ray communication unit of a transmission destination.

[0022]If connection-request \*\* from the IrLMP layer 11 is received, the IrLAP layer 12 of the infrared-ray-communication protocol 1 will generate connection handle \*\* immediately after that, and will notify the connection handle \*\* to the IrLMP layer 11.

[0023]After that, the IrLAP layer 12 transmits SNRM frame \*\* to the IrLAP layer 22 of the infrared-ray-communication protocol 2. Transmission of SNRM frame \*\* from the IrLAP layer 12 to the IrLAP layer 22 is performed by infrared rays.

[0024]The IrLAP layer 22 will output connect indication \*\* to the IrLMP layer 21, if SNRM frame \*\* is received from the IrLAP layer 12. The IrLAP layer 22 will transmit UA frame \*\* to the IrLAP layer 12, if connect indication \*\* is answered and connection response \*\* is sent from the IrLMP layer 21. Transmission of UA frame \*\* from the IrLAP layer 22 to the IrLAP layer 12 is also performed by infrared rays.

[0025]The IrLAP layer 12 will notify connection-confirm \*\* to the IrLMP layer 11, if

UA frame \*\* from the IrLAP layer 22 is received.

[0026]Drawing 2 is a flow chart which shows operation of the IrLAP layer 12 of drawing 1, Drawing 4 is based on one example of this invention, and also drawing 3 is based on one example of this invention, and also it is a sequence chart which shows operation when abnormalities occur before connection with a device, and it is a sequence chart which shows operation when abnormalities occur after connection with a device. Operation of one example of this invention is explained using these drawing 1 - drawing 4.

[0027]If connection-request \*\* from the IrLMP layer 11 is received (drawing 2 step S1), the IrLAP layer 12 of the infrared-ray-communication protocol 1 will generate connection handle \*\* immediately after that, and will notify the connection handle \*\* to the IrLMP layer 11 (drawing 2 step S2).

[0028]After that, the IrLAP layer 12 transmits SNRM frame \*\* to the IrLAP layer 22 of the infrared-ray-communication protocol 2 (drawing 2 step S3). Transmission of SNRM frame \*\* from the IrLAP layer 12 to the IrLAP layer 22 is performed by infrared rays.

[0029]If transmission of SNRM frame \*\* from the IrLAP layer 12 to the IrLAP layer 22 is normal at this time (drawing 2 step S4), UA frame \*\* will be returned to the IrLAP layer 12 from the IrLAP layer 22. Transmission of UA frame \*\* from the IrLAP layer 22 to the IrLAP layer 12 is also performed by infrared rays.

[0030]That is, the IrLAP layer 22 will output connect indication \*\* to the IrLMP layer 21, if SNRM frame \*\* is received from the IrLAP layer 12. The IrLAP layer 22 will transmit UA frame \*\* to the IrLAP layer 12, if connect indication \*\* is answered and connection response \*\* is sent from the IrLMP layer 21.

[0031]However, the IrLAP layer 12 notifies abnormalities to the IrLMP layer 11 that transmission of SNRM frame \*\* from the IrLAP layer 12 to the IrLAP layer 22 becomes unusual with disconnect indication via connection handle \*\* (refer to drawing 3 (drawing 2 step S9)). (drawing 2 step S4)

[0032]On the other hand, connection-confirm \*\* is notified to the IrLMP layer 11 that transmission of SNRM frame \*\* to the IrLAP layer 22 is performed normally, and the IrLAP layer 12 receives UA frame \*\* from the IrLAP layer 22 (drawing 2 step S6). (drawing 2 step S5)

[0033]If the abnormalities in a negotiation result do not occur at this time (drawing 2 step S7), the IrLAP layer 12 performs data transfer to the IrLAP layer 22 based on the directions from the IrLMP layer 11 (drawing 2 step S10). These processings are repeatedly performed until data transfer is completed (drawing 2 step S11).

[0034]On the other hand, the IrLAP layer 12 notifies abnormalities to the IrLMP layer 11 that the abnormalities in a negotiation result occur with disconnect indication via connection handle \*\* (refer to drawing 4 (drawing 2 step S8)). (drawing 2 step S7) It is possible to perform communication to the infrared-ray-communication protocol 1 from the infrared-ray-communication protocol 2 as well as the above-mentioned processing operation.

[0035]Thus, the IrLAP layers 12 and 22 which it carries out using a serial infrared-ray-communication mechanism, and also manage the protocol of the infrared ray communication between devices, In the infrared ray communication unit containing the IrLMP layers 11 and 21 which manage a data link using the function of the IrLAP layers 12 and 22, By generating connection handle \*\* which is an interface between the IrLAP

layers 12 and 22 and the IrLMP layers 11 and 21 in the IrLAP layers 12 and 22 immediately after registration of connection-request \*\* from the IrLMP layers 11 and 21, and notifying that to the IrLMP layers 11 and 21, The abnormalities in a negotiation result which may be caused before connection normal termination can be notified to the IrLMP layers 11 and 21.

[0036]

[Effect of the Invention]The physical-link layer which it carries out using an infrared-ray-communication mechanism according to this invention as explained above, and also manages the protocol of the infrared ray communication between devices, In the infrared ray communication unit containing the link management layer which manages a data link using the function of a physical-link layer, By generating the connection handle which is an interface between a physical-link layer and a link management layer in a physical-link layer immediately after registration of the connection request from a link management layer, and notifying that to a link management layer, It is effective in the ability to notify the abnormalities in a negotiation result which may be caused before connection normal termination to an IrLMP layer.

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## TECHNICAL FIELD

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[Field of the Invention]This invention relates to the serial infrared ray communication unit which performs communication between other devices with infrared rays with the serial infrared-ray-communication mechanism of IrDA (Infrared DataAssociation) standard conformity especially about an infrared ray communication unit.

## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a key map showing the infrared-ray-communication protocol by one example of this invention.

[Drawing 2]It is a flow chart which shows operation of the IrLAP layer of drawing 1.

[Drawing 3]It is based on one example of this invention, and also is a sequence chart which shows operation when abnormalities occur before connection with a device.

[Drawing 4]It is based on one example of this invention, and also is a sequence chart which shows operation when abnormalities occur after connection with a device.

[Drawing 5]It is a flow chart which shows operation of the IrLAP layer of a conventional example.

[Drawing 6]It is based on a conventional example, and also is a sequence chart which shows operation when abnormalities occur after connection with a device.

[Drawing 7]It is based on a conventional example, and also is a sequence chart which shows operation when abnormalities occur before connection with a device.

[Description of Notations]

1 and 2 Serial infrared-ray-communication protocol

11, 21 IrLMP layer

12, 22 IrLAP layer

\*\* Connection request

\*\* Connection handle

\*\* SNRM frame

\*\* UA frame

\*\* Connection confirm

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## CLAIMS

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[Claim(s)]

[Claim 1] It is an infrared ray communication unit containing a physical-link layer which it carries out using an infrared-ray-communication mechanism, and also manages a protocol of infrared ray communication between devices, and a link management layer which manages a data link using a function of said physical-link layer, A connection handle which is an interface between said physical-link layer and said link management layer is generated immediately after registration of a connection request from said link management layer. An infrared ray communication unit having a means to notify that to said link management layer, in said physical-link layer.

[Claim 2] The infrared ray communication unit according to claim 1 by which a means to notify disconnect indication to said link management layer via said connection handle when abnormalities occur in infrared ray communication between said other devices being included in said physical-link layer.

[Claim 3] A physical-link layer which it carries out using an infrared-ray-communication mechanism, and also manages a protocol of infrared ray communication between devices, and a link management layer which manages a data link using a function of said physical-link layer are included, At the time of a connection-request receptionist from said link management layer. Transmit a demand frame for a connection negotiation to a physical-link layer of said other devices from said physical-link layer, and in said link management layer from said physical-link layer at the time of reception of a response frame corresponding to said demand frame from a physical-link layer of said other devices a connection confirm. It is an infrared ray communication unit to notify, Answer said connection request and a connection handle which is an interface between said physical-link layer and said link management layer is generated before transmission of said demand frame. An infrared ray communication unit having a means to notify that to said link management layer, in said physical-link layer.

[Claim 4] The infrared ray communication unit according to claim 3 by which a means to notify disconnect indication to said link management layer via said connection handle when abnormalities occur in infrared ray communication between said other devices being included in said physical-link layer.

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